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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/070,908	05/04/98	SAKAMA M	0756-1799

IM62/1006
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EXAMINER	
PADGETT,M	
ART UNIT	**PAPER NUMBER**
1762	11

DATE MAILED: 10/06/99

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.	Applicant(s)
09/070,908	Sakama
Examiner	**Group Art Unit**
M.L. Padgett	1762

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Response

A SHORTENED STATUTORY PERIOD FOR RESPONSE IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a response be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for response is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication .
- Failure to respond within the set or extended period for response will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

☒ Responsive to communication(s) filed on 8/25/99.

☐ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle,* 1935 C.D. 1 1; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 23 - 50 is/are pending in the application.

Of the above claim(s) 30 is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 23 - 29 + 31 - 50 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claim(s) _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 11 9(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 1 7.2(a)).

*Certified copies not received: _____.

Attachment(s)

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of References Cited, PTO-892

☐ Notice of Informal Patent Application, PTO-152

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Other _____

Office Action Summary

1. The request filed on 8/25/99 for a Continued Prosecution Application (CPA) under 37 CFR 1.53(d) based on parent Application No. 09/070,908 is acceptable and a CPA has been established. An action on the CPA follows.

2. Claims 23-50 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 23 "a hydrogen gas" (lines 2 and 8); "a silicon containing gas" (lines 5 and 9-10); and "an amorphous film comprising silicon" (lines 6 and 11), are all introduced twice, hence the second occurance needs to either have its article corrected to show antecedent basis (like it use to) or needs to be appropriately differentiated, so that it can be clear in the claims whether or not the same or different gases and films are intended to be claimed. While not necessary as phrased, it would also be appropriate in line 8 to insert --first-- before "step" and in line 9 --third-- before "step", in order to keep the nomenclature consistent and easy to read (refer back).

Analogous problems as described for claim 23 are found in the other independent art claims 24,25,26,27,28,29 and 30, with the last claim having carbon instead of Si.

Also note two introductions for "radio frequency energy" on lines 3 and 5 of claim 25 causing similar ambiguities in intended meaning, with claims 26, 27, 28, 29 (twice) and 30.

In claim 26, it is noted that in the last line the meaning of "...by itself" is less than clear. Does this mean the discharge gas does not spontaneously form a film, but that it can in some circumstances, such as when combined with RF energy, or another gas, etc? The intended limits are unclear. Also, see column 27.

In claim 28, the limitation "a multilayer" is introduced twice (lines 1-2 and the last).

The phrasing in claims 48-50 does not clearly relate the times claimed therein to any steps or actions in the ~~columns~~ claims from which they depend, hence have no necessary effect on the claims. The examiner suspects that "discharge" is intended to refer to --said radio frequency discharge--, but the claims as written are not so limited.

3. Claims 23-50 remain rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Applicant's claims are replete with new matter and the apparent contention that since α-Si is taught (i.e., films containing only amorphous Si) that applicants are entitled to any amorphous film as long as it contains some Si is not convincing. No support for either "amorphous film comprising silicon" or "a film comprising carbon" was found. There are statements such as p. 1, line 5 directed to generic thin film deposition, however, no silicon or carbon films that may contain significant other constituents, i.e. are "comprising" Si or C, were found. Reference to amorphous silicon films is found throughout the specification, with page 7 also mentioning microcrystalline Si or crystalline silicon, but no support for "...comprising..." which is open language. Page 31 and 11 mentioned above, support "hard carbon" and DLC were found, but no films that are "comprising carbon" so these broader than disclosed limitations are New Matter. Note that "hard" is relative and not defined therein.

Furthermore, no "silicon containing gas" nor "carbon containing gas" is supported by the specification, so are also new matter. As previously discussed, the misnomer "silicide gas" can be given no accurate meaning in the context of the disclosure, except that applicant relates it to silane (SiH_4) and disilane (pages 8,11, etc). On page 11, use of methane gas for

the carbon deposits is disclosed, but not the broader limitation of claim 30.

In the claims where applicants use of RF energy ambiguously, it is not necessarily clear that they require the film deposition to be caused by plasma or RF discharge, as use of RF energy does NOT necessitate that any plasma formation or discharge actually takes place unless the antecedent basis is clear, since radio frequency energy may be used to power heaters, etc. The specification, specifically, from the first sentence to the end requires that the claimed deposition be via RF plasma discharge, hence this ambiguous broadening of scope might also be New Matter.

4. Claim 30 is directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: carbon deposition is a different species of film deposition from silicon deposits, involving different chemistry than silicon film deposition, and was removed from consideration in the previous action due to the original presentation. Hard carbon films disclosed by applicant's specification are a distinctly different species than any of the disclosed Si films.

5. The disclosure is objected to because of the following informalities: Proof reading of the specification is needed, in

particular use of "decompressed" or "decompression chamber" and "silicide gas", used throughout the specification need to be corrected, in light of the comments in the previous actions rejection. Clear support for non-grammatical changes should be provided.

Appropriate correction is required.

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 23, 25-29, 45, 47, 48 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kozuka in view of Gupta et al. Kozuka teaches deposition of multiple layer non-monocrystalline semiconductor devices, exemplified by deposition of amorphous silicon TFT (thin film transistors), by forming successive layers in a manner such that a plasma atmosphere is constantly maintained from the start until the end of the film

formation process, in order to protect the interfaces from damage by initial stages of plasma formation and from contamination (Abstract), as typically found in discontinuous plasma processes (col. 2, line 57- col. 3, line 7). In col. 4, lines 38-49, Kozuka particularly teach that "since the plasma is continuously generated, the start and end of film formation can be achieved by changing the raw material gas. During film formation, therefore, the raw material gas is preferably used not singly but as a mixture with a diluting gas. With the use of such mixed gas, when the supply of the raw material gas is terminated after the completion of film formation, the discharge is maintained by the diluting gas so that the fluctuation in plasma can be suppressed. The diluting gas can be hydrogen, argon or helium...". Embodiments 2 (col. 6, line 55- col. 9, line 12) and 3 (col. 9, line 15-col. 10, line 22), form plasma deposited amorphous Si TFT films using silane gas and H_2 as a dilutant, with the first deposition being a plasma deposited Si_3N_4 insulating film, followed by films that read on claimed deposits. Reactant gas (SiH_4) flow is stopped in each plasma chamber and the dilutant gas plasma continues in that chamber before transfer to the next chamber, where the dilutant gas plasma is present before reactive gas starts to flow into the chamber.

Kozuka differs from applicant's claims by using H_2 dilutant gas during both deposition and non-deposition plasmas in their examples, and by stating a preference for the dilutant gas (H_2 or Ar or He) to be mixed with the reactant gas, while applicant's only use hydrogen gas or "discharge gas" (equivalent to Kozuka's dilutant gas) during their non-deposition plasma, either before or after the amorphous silicon containing deposition. From col. 4, lines 50-62, it appears that the main reason the dilutant gas is used with the reactant gas is so that only one gas flow needs to be changed and thus avoid problems if ones flow control equipment has slow response, however, as is seen by the teachings of Gupta et al. (Abstract; col. 2, lines 50-54; col. 3, lines 16-38; col. 5, lines 30-50; col. 6, line 61-col. 7, lines 20 and 35-40; and claims 9-11, especially col. 5, line 39-42) that for an inert plasma gas, such as Ar, used for pre- or post-processing (deposition) plasma that prevents particle contamination of the substrate, that the inert gas maybe stop simultaneous with start of the reactant gas, such that constant plasma is maintained and particle contamination prevented. Given the teachings of Gupta et al. which are taught to be generally applicable to plasma processes, including depositions and processes exemplified by using silicon containing gases such as TEOS, it would have been

obvious to one of ordinary skill in the art, that the dilutant gas of Kozuka (H_2 or Ar or He) need not have been mixed with the reactant gas, because it is not needed for the chemical reaction involved in the deposition, and Gupta et al. shows that is possible to achieve the objective of Kozuka (preventing contamination and achieving a full plasma before introducing reactant gas, i.e., equivalent to no plasma on/off hysteresis) via switching from inert gas to reactant gas, instead of maintaining the inert or dilutant gas flow throughout the sequence. Obviously, if ones equipment has poor gas flow timing control, one would not use the modification form Gupta et al., but where sufficient regulation abilities exist, one would have been further motivated by saving resources from wasteful or un-need use.

The timings for length of non-coating plasmas will depend on mechanical and electrical abilities of the systems, and be determined by routine experimentation by the competent practitioner. Note Kozuka discusses TFT devices in general and the presence of a gate electrode on the substrate before deposition of Si_3N_4 and α-Si layers on col. 7, lines 45-55.

8. Claims 24,46 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kozuka in view of Gupta et al. alone as

applied above, or further in view of Mei or Kaschmitter et al. or Yamuzaki et al.

Kozuka teaches initial plasma deposition of an insulating layer of silicon nitride in embodiments 2 and as mentioned above, and generally discusses the important of the interface between amorphous Si and the insulating film (col. 3, lines 8-28), but does not specifically discuss silicon oxide as the insulating film, however as SiO_2 and Si_3N_4 are conventionally used as alternative dielectrics in semiconductor devices, it would have been obvious to one of ordinary skill in the art to substitute one for the other in the teachings of Kozuka.

Alternately, any of the optional tertiary references show the use of silicon oxide layers as claimed. In Kaschmitter et al., see claims 20,22 and 24; col. 4, line 49-col. 5, line 10 and col. 7, lines 25-27. In Yamuzaki et al. see Abstract, col. 20, lines 15-49, especially 35-39 where silicon oxide and silicon nitride are taught to be equivalently used, and claims 1,5,7,9 and 14. In Mei et al., see Abstract; col. 1, lines 44-49; col. 2, lines 33-66, especially lines 58-60; col. 3, lines 1-6, where SiO_2 is seen to be used before α-Si deposits in TFT device manufacture. Hence, use of silicon oxides as claimed, would have been an obvious alternative to Kozuka's taught silicon nitride as

it has been shown to be a known equivalent alternative thereto in analogous processes and structures.

9. Claims 31-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kozuka in view of Gupta et al. as applied to claims 23-39 and 45-50 above, and further in view of Mei et al. or Kaschmitter et al. or Yamuzaki et al.

These claims differ from the combination to Kozuka and Gupta et al in requiring that the amorphous Si containing film be crystallized using laser light, however the references of Mei et al, Kaschmitter et al. and Yamuzaki et al. already introduced above, show that it is old and well known to use lasers to induce crystallization in α-Si layers in TFT structures (Abstracts, previously cited sections, plus), hence it would have been obvious to one of ordinary skill in the art to further treat the structures produced in Kozuka (as combined with Gupta et al.) as shown in any of these ternary references, because these conventional laser annealing technique are shown to be desirable for TFT devices.

10. Czubatyj et al. was cited as equivalent to Mei et al. Kaschmitter et al. and Yamuzaki et al for laser crystallization of α-Si in TFT devices, and for teachings of interest on the

alternative use of SiO_2 or Si_3N_4 deposited by PECVD for gate insulators used in those devices.

11. Applicant's arguments filed 8/2/99 discussed above and in the 8/16/99 advisory have been fully considered but they are not persuasive. It is further noted that the teachings of Gupta et al. could stand alone for those claims which only require a discharge gas, hence read on inert gas (Ar, He) as discussed in col. 6, lines 61+ of Gupta. Whether or not the Si-containing deposits of Gupta would be amorphous would depend on needs of the device being formed and particular deposition parameter, all easily determined by one of ordinary skill in the art.

12. Any inquiry concerning this communication should be directed to M.L. Padgett at telephone number (703) 308-2336 and FAX # (703)305-5408 (official); 305-3599 (after final) and 305-6078 (unofficial).

Padgett/JW
September 28, 1999

MARIANNE PADGETT
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